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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

A Roundheaded Pine Beetle[1] Outbreak in New Mexico:

Associated Stand Conditions and Impact

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The roundheaded pine beetle, Dendroctonus adjunctus Blandford, infests Pinus ponderosa Laws. in mixed second-growth stands in the Sacramento Mountains of south-central New Mexico. In six areas, losses ranged from near 0 to over 50 percent of the ponderosa pine stand component, both in number of trees and basal area. Overall, living ponderosa pine averaged 45.8 ft^2 basal area per acre, while infested and dead averaged 15.8 ft^2. Infested trees averaged 6.5 inches d.b.h.; uninfested trees, 7.4 inches.

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The roundheaded pine beetle infests ponderosa pine, Pinus ponderosa Laws., in the southwestern United States, and other species of pines southward to Guatemala (Chansler 1967). In the past 5 years it has caused considerable tree mortality in the Sacramento Mountains of south-central New Mexico. One survey report[4] refers to losses such as ". . . basal area stocking reduced up to 50 percent in some areas . . ." and "... up to 40 infested trees per acre in selected areas."

Since an extensive gross acreage has been infested during the recent outbreak (fig. 1), land managers — primarily private individuals, Forest Service, and Bureau of Indian Affairs — have needed more information on how much damage the infestation has actually caused. Researchers have needed similar information to judge how much and what kind of effort to allocate to the roundheaded pine beetle. Data were therefore collected in 1971 and 1972 to determine impact — solely on the timber stands themselves — of the roundheaded pine beetle in representative infestation areas in the Sacramento Mountains.

We attempted to answer these questions: What were affected stands like before the beetle outbreak? How much has the infestation changed stand density? Has species composition been altered? What size trees are attacked? What tree crown classes are most likely to be attacked? How are trees growing in the infested stands? Is there regeneration to replace lost trees? How much dwarf mistletoe is present in the infested stands?

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[4] *Flake, Harold W., Jr. 1970. Unpublished forest insect survey report on file at Southwestern Region, USDA For. Serv., Albuquerque, N.M.*

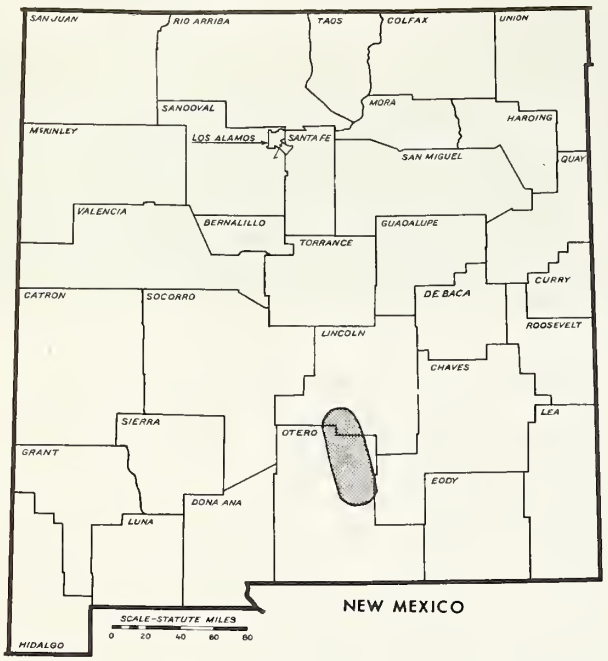

Figure 1.—Roundheaded pine beetle infestation orea, New Mexico, 1968-72.

Methods

Six sample areas were chosen to represent what we judged were typical infested stands. Areas 1, 2, and 3 (1/20-acre plots) were examined in 1972; areas 4, 5, and 6 (1/10-acre plots) were examined in 1971.

Area	Approximate location	Approx. infested acreage	No. plots
1	4 mi NE Cloudcroft Sec. 21, T15S, R13E	80	40
2	5 mi NW Sacramento Sec. 21, T17S, R13E	200	40
3	7 mi N Ruidoso Sec. 20, T10S, R13E	80	40
4	4 mi NW Sacramento Sec. 20 & 21, T10S, R13E	190	92
5	8 mi NW Mayhill Sec. 24, T15S, R14E	230	115
6	6 mi NE Cloudcroft	528	248

The infested stands included varying mixtures of ponderosa pine, southwestern white pine (P. strobiformis Engelm.), white fir (Abies concolor (Gord. and Glend.) Lindl.), pinyon (P. edulis Engelm.), juniper (Juniperus spp.), oak (Quercus spp.), Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco), and quaking aspen (Populus tremuloides Michx.).

Circular plots were established at 2-chain intervals along parallel lines generally 5 or 10 chains apart. Within each plot we recorded species and diameter of all trees over 4 inches d.b.h. Ponderosa pines were classified as alive, infested, or recently dead (killed during the current beetle outbreak). Practically no older snags were present, and no effort was made to record them. Mortality in species other than ponderosa pine was essentially zero.

In areas 1, 2, and 3, additional information was obtained on: (1) presence or absence of dwarf mistletoe, (2) amount of regeneration from seedlings to saplings up to 4 inches d.b.h. within four square 1-milacre subplots clustered at plot centers, (3) crown class of each ponderosa pine, and (4) recent growth of a single dominant or codominant ponderosa pine as indicated by increment cores.

Results

Losses attributed to beetle activity varied considerably between sample areas. Reduction in the ponderosa pine component ranged from more than 50 percent in area 1 to about 10 percent in areas 3 and 4 (table 1). Current beetle-caused mortality, as indicated by numbers and basal area of currently infested trees, varied from zero in area 5 to almost 10 percent of the green stand in area 1 (table 2). Overall (all areas combined), the remaining green, uninfested ponderosa pine stand averaged 45.8 ft^2 basal area per acre; 15.8 ft^2 were infested or dead.

Average diameter of living and killed trees was generally about the same (table 2), 7.4 and 6.5 inches d.b.h. respectively, when averages for all six sample areas are combined. Area 3, where several large trees were infested, was an exception. There may be a tendency for the larger trees to be infested if beetle activity is relatively light. This is seen in areas 4 and 6, in which currently infested trees make up 0.9 ft^2 basal area per acre or less.

Species composition was altered in several instances. In area 1, ponderosa pine comprised about 60 percent of the basal area prior to infestation, but in 1972 it made up only about 30 percent; Douglas-fir replaced pine as the dominant species (table 1). At the other extreme, species composition in areas 3, 4, and 5 was hardly affected.

Table 1.--Live basal area (ft^2 per acre) of all species in 1972, and ponderosa pine only in 1968 (before infestation), roundheaded pine beetle infestation area, Lincoln National Forest, New Mexico[1]

Area	Ponderosa pine 1968	Ponderosa pine 1972	Southwestern white pine	White fir	Douglas-fir	Pinyon	Juniper	Oak	Aspen	Total
1	62.0± 6.5	26.7±3.0	4.1±1.4	0.4±0.2	41.2±4.7	0	0	1.0±0.8	0.8±0.8	74.2
2	114.0±10.4	79.6±8.7	4.8±3.5	0	15.9±4.2	0	1.3±1.3	5.7±2.1	0	107.3
3	36.1± 5.4	32.7±5.3	0	0.3±0.2	5.0±2.3	12.7±2.6	8.8±2.6	3.5±1.5	0	63.0
4	22.5± 8.2	19.7±2.2	4.1±0.8	2.4±1.0	12.7±1.8	2.6±0.6	2.5±1.0	0	0	44.0
5	62.2± 9.9	58.8±9.8	1.9±0.6	0.5±0.3	14.1±3.3	13.8±3.1	22.4±5.1	1.3±0.9	0	112.8
6	72.0± 2.9	57.3±2.7	3.5±0.5	0.9±0.5	14.5±1.5	0.4±0.5	0.6±0.2	0	0	77.2

[1]Values for ponderosa pine in 1968 estimated by combining 1972 values for green, infested, and recently killed trees; values for other species from 1971 and 1972 surveys.

Table 2.--Depletion of ponderosa pine stand component resulting from 1968-72 roundheaded pine beetle outbreak, Lincoln National Forest, New Mexico (Mean values per acre, all trees $\geq$ 4 inches d.b.h.)

Area and stand component	Stems	Basal area	Diameter breast height
	Number	*ft^2*	*Inches*
Area 1:			
Living trees	99.5±11.3	26.7±3.0	6.6±0.4
Infested trees	10.0± 3.7	2.6±1.0	6.4±0.5
Dead trees	109.5±16.3	32.7±5.9	7.0±0.5
Area 2:			
Living trees	171.5±17.3	79.6±8.7	8.2±0.4
Infested trees	7.5± 2.6	2.7±1.0	7.9±0.5
Dead trees	98.5±15.0	31.7±5.2	7.0±0.7
Area 3:			
Living trees	87.5±14.7	32.7±5.3	7.4±0.7
Infested trees	1.0± 0.7	1.1±0.9	13.0±0.5
Dead trees	9.5± 3.5	2.4±0.9	6.5±0.4
Area 4:			
Living trees	66.4± 7.2	19.7±2.1	6.8±0.3
Infested trees	1.5± 0.6	0.5±0.2	7.3±0.2
Dead trees	9.7± 1.8	2.3±0.2	6.2±0.3
Area 5:			
Living trees	137.4±19.1	58.8±9.8	7.7±0.5
Infested trees	0	--	--
Dead trees	20.9± 5.6	4.3±1.2	5.8±0.5
Area 6:			
Living trees	153.9± 7.7	57.3±2.7	7.4±0.2
Infested trees	1.4± 0.5	0.9±0.4	9.2±0.2
Dead trees	48.9± 3.9	13.8±1.1	6.6±0.2

Losses tended to be concentrated in codominant trees, although there were as many infested and dead intermediates as codominants in area 3 (table 3).

Table 3.--Ponderosa pine crown classes (percent of trees), roundheaded pine beetle infestation area, Lincoln National Forest, New Mexico, 1972

Area and stand component	Dominant	Codominant	Intermediate	Suppressed
Area 1:				
Living	16.0	56.8	18.1	9.0
Infested and dead	17.9	62.7	12.6	6.7
Area 2:				
Living	10.2	54.5	25.7	9.6
Infested and dead	2.8	67.0	20.8	9.4
Area 2:				
Living	6.0	71.4	20.1	2.5
Infested and dead	9.5	42.8	42.8	4.8

Dwarf mistletoe was present in 85 percent of the trees on area 1, 57.5 percent on area 2, and 30 percent on area 3.

Coniferous regeneration was present on a majority of sampled subplots:

	Percent of subplots stocked with—		
Area	**Pine**	**Other conifers**	**Hardwoods**
1	17.5	57.5	42.5
2	35	30	70
3	42.5	67.5	62.5

Radial growth of sampled trees on areas 1 to 3 was slow:

Area	No. trees	Mean number rings, last radial inch
1	31	18.1 ± 3.2
2	38	19.1 ± 7.2
3	21	29.0 ± 12.0

Discussion

Stands supporting this outbreak of roundheaded pine beetle are characterized by a mixture of species, ponderosa pine generally predominating. The pines are small, mostly around 6 to 8 inches d.b.h. Dwarf mistletoe infection is common; Hawksworth and Lusher (1956) also found dwarf mistletoe on over 50 percent of their plots in the ponderosa pine type of the same general area.

Loss was lightest (green vs. infested and dead) in stands in which southwestern white pine, white fir, pinyon, juniper, and oak made up a more substantial portion of the total basal area. This pattern supports the generality that species diversity tends to minimize the impact of catastrophic mortality, such as may be caused by bark beetles.

The impact of these beetle infestations depends largely on the objectives of the land manager. If homesites are involved, and each tree is valuable for its contribution of shade or appearance, beetle infestation can be serious. Infestation could also be serious in areas devoted to pine timber production. In the Sacramento Mountains, however, procedures in addition to bark beetle control, including thinning and control of dwarf mistletoe, would also appear necessary if timber production were the goal.

This study suggests that the current Sacramento Mountains outbreak may have been less devastating than it appeared. Several of the sample areas, considered typical, have not suffered severe mortality. At worst, the ponderosa pine has been thinned, and the species mix has been altered. Other species, unaffected by the roundheaded pine beetle, are still present to maintain forest cover.

Roundheaded pine beetle outbreaks appear to be relatively short lived in second-growth stands such as these, and they may tend to be recurrent. The outbreak we have recorded here seems now to have mostly subsided. We will return to the same area in a few years to reevaluate stand characteristics and attempt to judge what the longer-term effects of the infestation were.

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